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AUTHOR	Tsikalas, Kallen; Gross, Elisheva F.; Stock, Elisabeth
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ABSTRACT

This paper proposes a new framework for examining how youth use computers and the resulting impacts on their school-related attitudes and behaviors. To characterize adolescents' computing activities, a theory is borrowed from psychologists that suggests there are three basic psychological needs that youth seek to satisfy through their activities: autonomy, belonging/relatedness, and competence. The paper demonstrates that young adolescents can and do appropriate computers to satisfy these three fundamental needs and that doing so is associated with positive school-related outcomes and preparation for future learning. Results indicate that being able to engage in computing at home is important for youth in order to realize these benefits and that low-income youth in particular have a tremendous amount to gain from home computing. Given the circumstances of poverty that surround their lives, these young people may find special refuge in home computing. Through computing, they find the means to satisfy their needs for autonomy, belonging and competence-needs that middle- and higher-income adolescents may find easier to fulfill in their safer and more supportive environments. Three figures show a conceptual map illustrating how adolescents' subjective experiences of home computing may fulfill their basic psychological needs; percentage of participants engaging in specific computing activities at least once during the three-day journal study; and percentage of participants reporting positive long-term impacts of home computing in the post-survey. Two tables provide information on adolescents' sharing around the home computer and adolescents' pride about their home computing activities. (Contains 18 references.) (Author/AEF)

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Applying a Youth Psychology Lens to the Digital Divide:

How low-income, minority adolescents appropriate home computers to meet their needs for autonomy, belonging, and competence and how this affects their academic and future prospects.

Kallen Tsikalas

Computers for Youth

Elisheva F. Gross

UCLA

Elisabeth Stock

Computers for Youth

Address Correspondence to Kallen Tsikalas, Director of Research & Learning Services, Computers for Youth, 505 8th Avenue, Suite #2402, New York, NY 10018. Electronic mail can be sent to ktsikalas@cfy.org.

Abstract

This paper proposes a new framework for examining how youth use computers and the resulting impacts on their school-related attitudes and behaviors. To characterize adolescents' computing activities, we borrow a theory from psychologists that suggests there are three basic psychological needs that youth seek to satisfy through their activities: *autonomy, belonging/relatedness, and competence*. We demonstrate that young adolescents can and do appropriate computers to satisfy these three fundamental needs and that doing so is associated with positive school-related outcomes and preparation for future learning. Our results indicate that being able to engage in computing at home is important for youth to realize these benefits and that *low-income youth*, in particular, have a tremendous amount to gain from home computing. Given the circumstances of poverty that surround their lives, these young people may find special refuge in home computing. Through computing, they find the means to satisfy their needs for autonomy, belonging and competence—needs that middle- and higher-income adolescents may be more easily fulfill in their safer and more supportive environments.

Applying a Youth Psychology Lens to the Digital Divide: How low-income, minority adolescents appropriate home computers to meet their needs for autonomy, belonging, and competence and how this affects their academic and future prospects

Kallen Tsikalas, Elisheva F. Gross and Elisabeth Stock

Past research on *children's computer and Internet use* has shown that young people use home computers to do homework, express themselves creatively, explore hobbies, pursue interests and possible careers, and play games (for a review, see Subrahmanyam, Kraut, Greenfield and Gross, 2001). When asked to categorize their use as related to entertainment, learning or "killing time," the majority of 8-18 year olds say they use computers "for entertainment" most of the time. About a quarter say they use computers to "learn interesting things" most of the time. Very few young people indicate that they are "just killing time" on their computers (Roberts, Foehr, Rideout, and Brodie, 1999). For teens, in particular, Internet use seems to be primarily a social event (Pew Internet Project, 2001). Regardless of socio-economic status, children use the computer as much for entertainment as for educational purposes (Becker, 2000).

Investigations of *children's home computing as related to school and academic outcomes* have demonstrated positive associations between home computing and English and math grades (Rocheleau, 1995). Home computing has also been linked to improvements in standardized test scores (Attewell and Battle, 1999; Chang, Honey, Light, Moeller, and Ross, 1998). However, studies documenting these effects have been careful to note mediating effects. Attewell et al. (1999) found that academic gains were mediated by factors related to children's cultural and social capital—factors such as the frequency of talk between students and their parents about school matters. Chang et al. (1998) attributed improvements in test scores not only to technology but also to extensive curriculum reforms and increased expectations on the part of students and teachers alike. Many studies have suggested that computing may help youth improve their self-confidence, increase their motivation, enhance their feeling of connectedness, and increase their involvement with their family (Reaux, Ehrich, McCreary, Rowland, and Hood, 1998; Rockman et al, 1998; Wartella, O'Keefe, and Scantlin, 2000; Torralba, 2001).

This paper proposes a new framework for examining how youth use computers and the resulting school-related outcomes. We investigate more carefully the social and recreational aspects of computing that others have also documented. However, we do not consider them as peripheral or secondary to educational computing. Rather we demonstrate that these forms of computing, like educational computing, can be highly relevant to school-related outcomes. We do not categorize computing activities into education, entertainment and social groupings. Rather, to characterize adolescents' computing

activities, we borrow a theory from psychologists – a theory that suggests there are three basic psychological needs that youth seek to satisfy through their activities: *autonomy, belonging/relatedness, and competence* (Deci and Ryan, 1991; Connell and Wellborn, 1991). We argue that young adolescents can and do appropriate computers to satisfy these three fundamental needs and that doing so is associated with positive school-related outcomes and preparation for future learning. (See also Tsikalas and Gross, 2002). We further posit that *low-income* youth have a tremendous amount to gain from home computing. This is contrary to arguments presented by Light (2001) and Samuelson (2002) suggesting that providing technology to low-income individuals may offer little promise for lifting them from the deep and complex problems of poverty.

We refer to the three basic psychological needs that psychologists have identified *autonomy, belonging/relatedness, and competence* as the "ABCs" of youth psychological development. (A) To be autonomous, individuals must feel that they possess a sufficient level of control over their own choices and activities and that they are recognized as themselves apart from any social or familial grouping. (B) To feel a sense of belonging, individuals must perceive they have strong and stable interpersonal relationships and that they are validated in these relationships. (C) To feel competent, individuals must be able to effectively bring about the results and outcomes that they desire from particular activities.

Working inductively from qualitative and quantitative data, we map participants' subjective experiences of computing to their psychological needs (see **Figure 1**). We suggest that adolescents' subjective experiences of sharing and receiving information around computing fulfill needs for belonging and competence. Experiences of learning are most related to feelings of autonomy and competence, and experiences of pride may simultaneously fulfill psychological needs for autonomy, belonging, and competence. We contend that in satisfying their ABCs, (even through "non-educational" activities) adolescents are likely to experience positive school-related outcomes.

Departing from previous studies, we assert that increases in self-confidence, motivation and connectedness related to computing demonstrate that youth are meeting basic psychological needs. This, in turn, is associated with increased school engagement and performance (Connell & Wellborn, 1991; Connell, Spencer, & Aber, 1994). Our results show that when adolescents increase their sense of belonging/relatedness through communication with any family member, not just parents as discussed by Attewell et al (1999) and Wartella et al (2000), they are more likely to experience school-related benefits of computing. We present evidence of the benefits of home computing on school-related outcomes: More positive attitudes about school and learning, and increased motivation and investment in education; improvements in students' predispositions to future, self-directed learning (e.g., increases in curiosity, confidence, and control).

Finally, we demonstrate that being able to engage in computing *at home* is a necessary for adolescents to appropriate computers for their own needs and personal development. The home is less restrictive than other environments (more time is available for computer use and more computing activities are acceptable); it is a nexus of family interactions; and it offers greater privacy (Tsikalas and Gross, 2002). The school contributes students' home computing practices by providing a culture that demonstrates the value and relevance of computing.

Method

Context : A comprehensive, community-centric computer distribution program

Participants in this study were enrolled in a program sponsored by Computers for Youth (CFY). CFY is a New York City based non-profit organization that places computers in the homes of underserved children and families and provides an array of services to help them use the technology to enhance learning in the home and to improve quality of life. CFY's approach to bridging the Digital Divide is unique in that it is both comprehensive and community-centric.

Comprehensive approach. CFY recognizes that it is not adequate to simply drop technology into the homes of low-income, novice technology users. In such, the organization provides a suite of services and opportunities to help underserved children and families become skilled technology users. With its school and community partners, CFY provides basic computer training; technical support; tailored web content; teacher support services; and opportunities for young people to become creators, not just consumers, of information technology.

Community-centric approach. Rather than providing children and families with computers on an individual basis, CFY saturates entire communities. CFY selects middle schools in New York City with high poverty statistics and strong district support. The organization then provides home computers to every family with a child in the school and every teacher in the school. In this way, students and their families have a cohort of peers with whom to share experiences and learn. Additionally, teachers can assume that all of their students have access to home computers and adjust their practices accordingly.

Computer systems distributed. Participants in CFY's program receive Pentium-level, IBM-compatible computers outfitted with a suite of software programs (Microsoft Windows 98, Office 2000, a typing program, and Cybersitter 2000—an Internet filtering product); a web browser set to the Community Corner website—CFY's portal site; and a school-wide communication system called FirstClass. Through FirstClass, all students, parents, and teachers receive email accounts, and can use features such as chat, class folders and bulletin boards. CFY provided the families participating in this

study with a free advertising-supported Internet Service Provider.[1] Families may switch to any other provider if they choose to do so.

During the 2000-2001 school year, CFY provided home computers and support services to approximately 400 underserved students and families in three low-income, New York City neighborhoods. Participants in this study were recipients of CFY's 2000-2001 services and were demographically representative of the entire population of students served by CFY's program.

Participants

Eighty-nine (89) students participated in the present research. The sample consisted of 43 males and 46 females, ranging in age from 12 to 15 years of age, with the majority aged *13* (M = *13*, SD = *0.772*). Of the *87* participants who reported their ethnicity, *39.1*% identified themselves as African-American , *36.8* % as Hispanic/Latino, *13.8*% as being of mixed heritage (African-American and Hispanic/Latino), *8.0*% as Carribbean, and *2.3*% as Asian.

Participants were enrolled as seventh or eighth graders at one of two middle-schools in New York City—the Arts and Education Academy (AEA) in East Harlem and the Brooklyn Comprehensive School (BCS) in East New York.[2] Based on data from the New York City Board of Education, over 90% of students at each of these schools met the criteria to receive free lunch services.

School Characteristics

Arts and Education Academy. AEA is a public middle school that serves students in grades seven and eight. It is located in a building that also houses four other small schools. The administration and staff at AEA are committed to providing students with an education that develops and supports both their creativity as well as their cognitive growth. In most classes, teachers make an effort to combine art projects with academic instruction. For example, during the time of the study, AEA students wrote and produced an opera. In collaboration with the Metropolitan Opera Guild, the students worked in their English classes to create the script and song lyrics. In their art classes and after school, they created the set and costumes for the opera.

There is a dedicated technology teacher at AEA, and every student is enrolled in a computer class. This computer teacher is also certified to teach both science and art, and she uses a project-based approach in her computer instruction. During the period of the study, technology projects at AEA included the development of business identity (e.g., logo, slogan, business cards, and business plan); the

[1] After the 2000-2001 school year, CFY switched from providing families with a free advertising-supported Internet service provider (ISP) to providing them with a pre-paid ISP. This switch was in response to the rapid change in the economy and its effect on most free ISPs.

[2] The names of the schools discussed in this paper are pseudonyms.

creation of books based on Shakespearean plays, and the development of mathematical tessellations related to the work of M.C. Escher.

The principal at AEA has encouraged teachers and students to use the community e-mail system. Each teacher has his or her own class folder on the system and bulletin boards have been established for virtual clubs such as the Harry Potter Book Club.

Brooklyn Comprehensive School. BCS is also a small middle school that serves students in grades six through eight. It shares a building with a high school. The administration and staff at BCS are committed to providing their students with a quality basic education. They emphasize writing and mathematics in their instruction and seek to prepare students for higher education and successful participation in the work force. The school offers additional opportunities for students to improve basic skills through a Saturday academy; many students participate in this program.

While there is a computer teacher at BCS, middle school, students do not attend regular computer classes. Students may use computers under the supervision of their subject-matter teachers in their regular classrooms. These teachers, particular the language arts and mathematics teachers, regularly assign project work that involves Internet searches. At the high school level, BCS also offers a career-building a program called CISCO Academy. Middle school students and teachers know of this program and have access to the CISCO lab when it is not being used by high school students.

While generally supportive of computing, the principal at BCS did not actively use the community e-mail system herself and therefore did not emphasize its use among teachers and students during the course of the study.

Data Collection Procedures

To assess how the young people in this study appropriated their home computers and to measure school-related outcomes, we employed a multi-method approach to data collection. We gathered a combination of quantitative and qualitative data from three sources:

1) Written surveys administered to students at school ***3-7*** months after CFY computer distribution;
2) Three consecutive end-of-day reports (journals) completed by students at home on a Tuesday, Wednesday and Thursday night during the spring semester, about 3 months post-distribution (adapted from Gross, Juvonen and Gable, 2002); and
3) Focus group interviews with students near the conclusion of the school year, 3-7 months after participants had received computers.

All of the adolescents included in this study completed ***both*** surveys and journals. A subsample of these students also participated in focus group interviews.

Data about school context and activities were derived primarily through informal and formal conversations with teachers.

Measures

Among the behaviors and impacts measured were extent of computer and Internet use at home, specific home computing activities, attitudes towards school and self, expectations for academic attainment, technical competencies, and social adjustment. Computing activities included those related to certain tools (e.g., word processing, chatting, designing graphics) as well as those related to certain circumstances of personal and interpersonal experiences of sharing information, receiving information, learning and feeling pride. School-related outcomes included participants' perceptions of doing better in school and investing more in their education as a result of having a home computer; attitudes towards school and towards self as student; personal/interpersonal impacts of computing such as feeling more curious, confident, in control or relaxed; and changes in relationships with family members, friends and teachers (for a more precise accounting of data measures see Tsikalas and Gross, 2002).

Data analysis procedures

We analyzed quantitative data using traditional statistical techniques (e.g., ttests, ANOVAs, and multiple regressions). Qualitative data was summarized and analyzed thematically.

Results

Baseline Data on Participants' Computing Practices and Activities

Participants used their home computers. On average, adolescents in the study spent approximately 1.5 hours per night on their home computers (M = 100.12 min, SD = 72.30). Eighth graders reported spending more time on the computer than seventh graders, t (87) = -2.42, $p < .05$. Average daily computer usage also varied marginally by school and by whether computer-related homework had been assigned. Students at AEA spent slightly more time on their home computers than students at BCS (Ms= 111.61 min, 80.61 min, t (87) = 1.99, $p < .06$). Students who reported that they had been assigned homework that required them to use their home computers, used their computers for more time than peers who had not received such assignments, (Ms= 117.58 min, 88.73 min, t (86) = 1.83, $p < .10$). Time on home computer was *not* significantly associated with students' gender, age, ethnicity, or prior home computer access.

Adolescents used computers most at home. More than two-thirds of participants (75.8%; n = 50) indicated that they used computers most at home. The remaining 16 students in the sample reported that

they used computers most at other locations, such as school, community technology centers, libraries, and friends' or relatives' homes. Students at AEA were more likely than those at BCS to use computers most at home, χ^2 (1, 66) = 4.13, $p < .05$. There were no differences by age, grade, gender or ethnicity in the location of greatest computer use.

Participants engaged in numerous computing activities. Students engaged in a variety of computing activities at home—word processing, playing games, designing and editing graphics, using the web, and communicating on-line via e-mail, chat, and instant messaging (IM). **Figure 2** presents these results. For the most part, daily computing activities did not differ by gender, age, grade, ethnicity, or prior home computer access. The two exceptions to this pattern were that girls were more likely than boys to IM, χ^2 (1,81) = 5.08, $p < .05$, and eighth graders were more likely than seventh graders to use their home computers for word processing, χ^2 (1,80) = 3.90 $p < .05$.

Several school-level differences in specific computing activities were observed. Students who attended at AEA were significantly more likely to use their home computers for four specific activities: to design/edit graphics, χ^2 (1,81) = 6.80 $p < .01$;to browse the web, χ^2 (1,81) = 4.29 $p < .05$; to communicate via e-mail, χ^2 (1,81) = 5.01 $p < .05$; and to IM, χ^2 (1,81) = 3.74 $p = .05$.

Descriptive Findings related to Participants' Fulfillment of Basic Psychological Needs

In the absence of direct measures for the constructs of autonomy, belonging and competence, we employed four proxy variables. These variables measured participants' subjective experiences of computing and were theoretically mapped to the ABCs of youth psychological development: Computing-related sharing and receiving of information were both indicators of belonging (B) and competence (C); computing-related learning was an indicator of autonomy (A) and competence (C); computing-related pride was an indicator of autonomy (A), belonging (B), and competence (C). Review **Figure 1** for an illustration of this conceptual map.

Participants shared information around home computing (B/C). Over the three-day period of the journal study, more than half (58.6%,$n = 51$) of participants reported that they showed or explained something on their computer to people at home. Whether students shared information with others was not significantly associated with their demographic characteristics or school. However, sharing was marginally related to whether or not they had been assigned homework requiring computer use. Participants who reported that they had been assigned homework that required them to use their home computers during the three day period were marginally more likely to indicate that they showed or explained something on the computer to someone in their home, χ^2 (1,86) = 2.94, $p < .10$.

Sharing occurred around many types of computing activities: Students explained to friends and family members how to use and customize basic hardware and software tools. They discussed activities

they enjoyed, displayed projects and products that they had created, and explained uses of computing that demonstrated a deeper understanding of the value of these tools. **Table 1** presents specific examples of computer-related sharing from the students' journals.[3]

Adolescents received information (B/C) around home computing. One-third of participants (33.7%, n=29) indicated that someone from home showed or explained something to them on their home computers. Females were marginally more likely than males to report this activity, χ^2 (1, 86)=3.05, p<.1. No other demographic or school variables were significantly associated with this activity.

For the most part, adolescents received information on how to accomplish specific tasks on their computers. They reported being shown "how to use a radio on the computer," "how to make a spreadsheet," "how to draw something and save it as a background," and "how to make slide shows." However, students also received information on more nuanced aspects of computing. One student said that she was taught that "you can't give out your number or address to people you don't know you met on the chat room." Another student indicated that her father "showed me the logic to a computer game called Minesweaper."

Adolescents learned things (A/C) by using their home computers. Almost half (44.2%, n=38) of the participants indicated that their computer helped them learn something at least once during the 3-day journal period. Latino students were significantly more likely than African-American students to report that they learned something, χ^2 (1,49)=5.89, p<.05. Similarly, students who were assigned homework that required them to use their home computers were more likely to report that they learned something on their home computers, χ^2 (1,85)=5.52, p<.05.

In their qualitative responses, these students often described learning activities that were related to their school work. For example, they noted that they learned: "New poetry of William Shakespeare," "about the lifestyles of people in Bolivia," "how breast cancer develop," and "information about the human body and other stuff." They also described improving their textual and numerical literacy: "The computer help me correct my spelling and improve my writing," "learn Spanish," and "It helped how to divide and multiply couse I wasn't that good at it." Finally, students indicated that they learned computer-related skills through their home computers: "How to type," "How to trouble shoot," "How to organize my e-mail," "I learn about networking," and "I learned how to search for things I need."

Participants experienced pride (A/B/C) around home computing. The majority of adolescents in the study (51.2%, n= 44) reported that they did something on their home computers that made them proud of themselves. Students who were assigned homework requiring them to use their home computers were

[3] Throughout this paper, students' comments are inserted verbatim, with misspellings and code language preserved.

moderately more likely to say that they did something on their home computer that made them proud, χ^2 (1, 85)=2.92 , p<.1. Pride was not significantly related to any demographic variables.

Participants noted that creating things on the computer, improving their skills and performance, improving social relationships, doing homework, and doing things with others made them feel proud of themselves. **Table 2** lists several students' descriptions of computing activities that made them proud.

Specific computing activities as related to participants' subjective experiences of sharing and receiving information (B/C), learning (A/C) and feeling pride (A/B/C). On a day-to-day basis:

- Adolescents who shared something on their home computers were significantly more likely to *use the web* and *chat* on-line, ps<.05. These students were also *marginally* more likely to use the computer for *graphics* and *e-mail*, ps<.1.
- Participants who had something explained, learned something, or did something on computer that made them proud to them on their home computer used their computers to design and edict *graphics* on a day-to-day basis, ps<.05.

Because of the lack of variance in data about game playing and using spreadsheets (over 80% of students played computer games; fewer than 15% used spreadsheets), we were not able to discern any quantitative associations between these activities and experiences of sharing and receiving information, learning and feeling pride around computing. However, qualitative data indicated that gaming, in particular, was often related to students' experiences of sharing, receiving and pride.

Self-Reported Impacts related to Home Computing

Computers made a difference to participants. Two-thirds (n = 46) of students reported that having a home computer made a difference in their lives; 14-year-old students were significantly more likely than their younger peers to report this impact, χ^2 (2, 67) = 10.96, $p < .01$. They also indicated specific personal and interpersonal impacts, such as increases in confidence, curiosity, control, and relaxation. These data are presented in **Figure 3**.

School-Related Attitudes and Expectations related to Home Computing

Participants' expectations for academic attainment. On the post-survey, nearly 40% (n = 26) indicated that they expected to attend a four-year college; another 33% (n = 22) reported that they expected to attend a professional school beyond college (e.g., law school, medical school). Students at BCS had marginally higher academic expectations for themselves than students at AEA, (Ms = 6.272, 5.818, t (64) = 1.85, $p < .10$).

Adolescents' school-related attitudes. Over half (53.6%) of the adolescents in this study agreed or strongly agreed that most of the time school was boring to them. Despite this, 91% of participants

indicated that they were good students, and 86.8% felt proud of the work they did for school. 80.6% of the students agreed or strongly agreed that their families were interested in their homework, and 75.7% felt the same about being able to express themselves creatively in their homework.

Associations Between Computing Activities and School-Related Outcomes and Impacts

A series of two-tailed Chi-square tests and t-tests was performed to examine associations between 1) specific computing activities and 2) subjective experiences around computing to the outcomes of interest: school-related attitudes and self-reported impact of home computing. When appropriate, ANCOVAs and multiple regressions were performed to verify the existence and strength of associations.

Participants' home computing activities are associated with school-related outcomes. Word processing, e-mail, instant messaging, and visiting websites were significantly associated with several school-related outcomes. Students who used word processing on a daily basis felt more pride in their work for school, (Ms = 3.38, 2.97, t (60) = -2.30, $p < .05$) and were better able to feel they could be creative in their homework (Ms = 3.12, 2.71, t (58) = -1.92, $p < .10$). Students who used e-mail on a daily basis were more likely to indicate that having a home computer helped them do better in school, χ^2 (1, 64) = 10.51, $p < .01$. Students who used instant messaging on a daily basis reported that they were better students (Ms=3.46, 3.09, t (60) = -2.14, $p < .05$) and that they felt marginally more pride in the work they did for school, (Ms = 3.36, 3.00, t (60) = -2.30, $p < .10$). Students who visited websites on a daily basis were marginally more likely to say that having a home computer increased their curiosity, χ^2 (1, 64) = 2.83, $p < .10$. It is notable that being assigned homework that required computer use was associated with *neither* school-related outcomes nor impacts.

Students' subjective experiences of sharing (B/C) are associated with school-related outcomes. Participants who shared something with another person using their home computers—those who addressed needs for belonging and competence—were more likely to report that having a computer had made a difference in their lives (χ^2 (1, 68) = 4.11, $p <.05$). These youth were also more likely to report that they were better students (Ms = 3.03, 2.96, t (64) = 2.31, $p < .05$) and that they put more effort into their education with their computer (Ms = 2.95, 2.44, t (65) = 2.22, $p < .05$). Adolescents who shared information around computers with people in their homes noted that school was less boring than their peers who did not share (Ms = 2.44, 2.85, t (66) = 2.05, $p < .05$).

Adolescents' subjective experiences of computing-related pride (A/B/C) are associated with school-related outcomes. Participants who did something on computer that made them proud—those who experienced some fulfillment of A/B/C—were more likely to report that they put more effort into their education with the computer (Ms = 2.97, 2.45, t (64) = 2.300, $p < .05$) and reported higher educational expectations for themselves, (Ms = 6.17, 5.66, t (62) = 2.213, $p < .05$). They were also more likely to

indicate that having home computer increased their curiosity (χ^2 (1, 68) = 5.26, $p < .05$) and were marginally more likely to feel that it improved their relationships with their families (χ^2 (1, 68) = 2.87, $p < .10$). In addition, adolescents who felt (vs. did not feel) computing-related pride on a daily basis were marginally less likely to feel that school was boring (Ms = 2.46, 2.83, t (65) = 1.908, $p < .10$) and were more likely to feel that having a home computer had made a difference in their lives, χ^2 (1, 67) = 3.34, $p < .10$.

Participants' subjective experiences of receiving computer-related information (B/C) are associated with school-related outcomes. Participants who reported that someone explained something to them on their home computer—those who to some extent satisfied their needs for belonging and competence—were significantly more likely to report that having a home computer made a difference in their lives, ?^{2} (1, 67) = 7.85, $p < .01$. These participants were also more likely to report that having a home computer helped them feel curious about more things χ^2 (1, 68) = 9.87, $p < .01$, helped them relax, χ^2 (1, 68) = 5.62, $p < .02$, and improved relations with family members, χ^2 (1, 68) = 4.24, $p < .05$.

Adolescents' subjective experiences of learning around computing are associated with school-related outcomes. Students who reported learning something on computer at least once across the three-day journal period—those who enhanced their autonomy and/or competence—were marginally more likely to report that that having home computer made a difference in their lives, χ^2 (1, 67) = 3.34, $p < .10$, and helped them like school more, χ^2 (1, 68) = 3.22, p < .10. These adolescents were significantly more likely to indicate that home computing helped them relax, χ^2 (1, 68) = 3.99, $p < .05$, feel more confident, χ^2 (1, 68) = 7.62, $p < .01$, curious, χ^2 (1, 68) = 7.07, $p < .01$, and in control, χ^2 (1, 68) = 7.09, $p < .01$. In addition, they were more likely to report improved relations with family as a result of home computer ownership, χ^2 (1, 68) = 5.19, $p < .05$.

The Importance of Being Able to Engage in Computing at Home

Using computers at home versus all other locations is significantly associated with a number of activities, practices and outcomes.

Time on home computer and computer-based activities. Adolescents who used computers most at home also spent more time on their computers than their peers who used computers most at other locations, (Ms = 109.50 min, 70.00 min, t (64) = 2.011, $p < .05$). Additionally, participants who used computers most at home versus anywhere else spent more time visiting websites, e-mailing, chatting, instant messaging, and communicating online with school peers, all $ps = .05$.

Subjective experiences around computing (A/B/C). Participants who used computers most at home experienced more pride around their computing activities. Fisher's two-tailed tests revealed that students

who used computers most at home (n = 49) versus anywhere else (n = 16) were significantly more likely to say that they did something on their home computer that made them proud, $p < .02$. These students were also marginally more likely to report that they shared something with another person using their home computer, χ^2 (1, 65) = 2.84, $p < .10$.

Self-reported impacts. Participants who used computers most at home were significantly more likely than their peers to say that having a home computer made a difference in their lives, χ^2 (1, 65) = 9.38, $p <$ .01. Similarly, adolescents who used computers most at home (n = 50) versus anywhere else (n = 16) were more likely to say that having a home computer helped them relax, $p < .01$ and helped them make new friends, $p < .10$. Both findings were verified by Fisher's two-tailed tests.

School-related outcomes. Fisher's two-tailed test indicated that students who used computers most at home (n = 50) versus anywhere else (n = 16) were significantly more likely to say that having a home computer helped them do better in school, $p < .001$. These students also reported greater feelings of pride in their schoolwork, (Ms = 3.25, 2.81, t (63) = 2.00, $p < .06$) and higher academic expectations for themselves, (Ms = 6.13, 5.56, t (60)= -2.12, $p < .05$).

The Importance of School Factors as related to Participants' Home Computing Practices

Using computers at home versus all other locations is significantly associated with a number of activities, practices and outcomes.

School is associated with participants' computer-based activities. Students who attended at AEA were significantly more likely to use their home computers for four specific computing activities: to design/edit graphics, χ^2 (1,81) = 6.80 $p < .01$;to browse the web, χ^2 (1,81) = 4.29 $p < .05$; to communicate via e-mail, χ^2 (1,81) = 5.01 $p < .05$; and to IM, χ^2 (1,81) = 3.74 $p = .05$. It is notable that AEA emphasizes arts and academics in its curricula and that it actively encourages students to engage in on-line communicating by structuring class-related and extracurric ular bulletin boards on the FirstClass community e-mail system.

Being assigned homework that requires the use of computers is marginally associated with participants' subjective experiences of computing. Participants who were assigned homework requiring them to use computers during the three-day journaling period were marginally more likely to indicate that they showed or explained something on the computer to someone in their home, χ^2 (1,86) = 2.94, $p < .1$, and that they experienced computing-related pride, χ^2 (1, 85)=2.92, p<.1.

Though being assigned homework that required computer use was *not* directly associated with school-related outcomes and impacts, it was associated through the adolescents' subjective experiences of computing-related sharing and pride.

Participants reference schoolwork in describing their subjective experiences of computing-related learning. When participants indicated that they had learned something by using their home computers, they often described skills and knowledge related to school. For instance, students noted that they learned about subjects like math, social studies "and even Spanish" with their computers.

Discussion and Conclusions

The patterns of intercorrelation described in this paper demonstrate that adolescents use home computers and the Internet to fulfill their needs for autonomy, belonging and competence. In satisfying these needs—particularly through subjective experiences of computing-related sharing, pride, learning, and receiving of information—participants are more likely to experience beneficial outcomes. Some of these positive outcomes are directly related to school (e.g., investment in education and attitudes about schoolwork and themselves as students); some are powerfully related students' predispositions to future, self-directed learning (e.g., increases in curiosity, confidence, and control).

Independent of the specific computing applications used, youth who share and receive information (B/C) and those who experience pride (A/B/C) and learning (A/C) around their home computers are likely to experience many more of the positive school-related effects of home computing. Though some specific computing activities—visiting websites, word processing, e-mailing and IMing—appear to be associated with adolescent's perceptions of positive impact and more positive attitudes towards education, young people's subjective experiences of computing are more strongly related to these outcomes.

In the present sample, students who shared and received information and those who experienced pride and learning in the course of their home computer use more often reported that they are good students and that they put more effort into their educations as a result of having home computers, and less often reported that school is boring to them. They were more likely to indicate increases in curiosity and confidence and improved relationships with family members, and, on average, expressed greater pride in their schoolwork and higher academic expectations than did youth who did not report such daily computer-related experiences.

Being able to engage in computing at home is important for youth to realize the psychological benefits of computers and the Internet. Participants who used their computers most at home spent more time on their computers, engaged in more Internet-based practices, and were more likely to report that they shared information with people in their homes and participated in activities that made them proud of themselves. Adolescents who used computers most at home felt that having a computer at home helped them relax, make new friends, and do better in school. They reported higher academic expectations and more pride in their schoolwork than did peers who used the computer most outside the home.

Similarly, school shapes the ways students approach computing at home by providing a culture that demonstrates the value and relevance of computing and by structuring home computing practices through assignments of homework that require students to use their computers. The different curricular emphases of the two schools in this study affected the specific computing activities in which their students engaged as well as their students' descriptions of computing-related learning. Similarly, homework assignments requiring computer use positively affected students' subjective experiences of computing-related sharing and pride. Though simply being assigned homework requiring the use of computers was not directly related to positive impacts, the association between homework and experiences of sharing and pride suggests that the most vital function of computer-related homework assignments may ultimately be to promote interpersonal exchange in the home

Two limitations to the present research should be noted. First, all data was self-reported by participants. Future research should include third party data on students' performance in and attitudes towards school, including teachers' reports, school grades, test scores, attendance and disciplinary records. Second, all associations reported here are correlational; as a result, we cannot make inferences regarding the direction of causality. In future research, we will more directly measure the constructs of autonomy, belonging, and competence. We will examine longitudinally associations among participants' computing experiences, attitudes, skills and achievement through the administration of surveys both prior to and three to seven months following distribution of home computers. In addition, we plan to conduct a controlled study, comparing students who have and have not yet received CFY computers, to determine the extent to which our findings may be explained by home computing per se versus other factors. Finally, we wish to explore more carefully the mechanisms by which school assignments and cultures of computing affect what happens in students' homes.

In summary, the present research provides preliminary evidence that low-income, minority, urban adolescents appropriate computers to satisfy their needs for autonomy, belonging, and competence and that doing so is associated with positive school-related outcomes and preparation for future learning. Furthermore, we demonstrate that young people need computing experiences *both at home and school* to effectively meet their needs for these needs.

Finally, in contrast to recent claims about children of the Digital Divide, we find that *low-income* youth have a tremendous amount to gain from home computing. Given the circumstances of poverty that surround their lives—unsafe neighborhoods; single-parent (or grandparent)-headed homes; poorly resourced schools; lack of economic resources to participate in enhanced cultural or educational opportunities; and adult family members who may not have the time, interpersonal skills or positive self image necessary to nurture and support their children's growth—these young people may find special refuge in home computing. Through computing, they find the means to satisfy their needs for autonomy,

belonging and competence—needs that middle - and higher-income adolescents may be more easily fulfill in their safer and more supportive environments.

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Figure 1: A conceptual map illustrating how adolescents' subjective experiences of home computing may fulfill their basic psychological needs

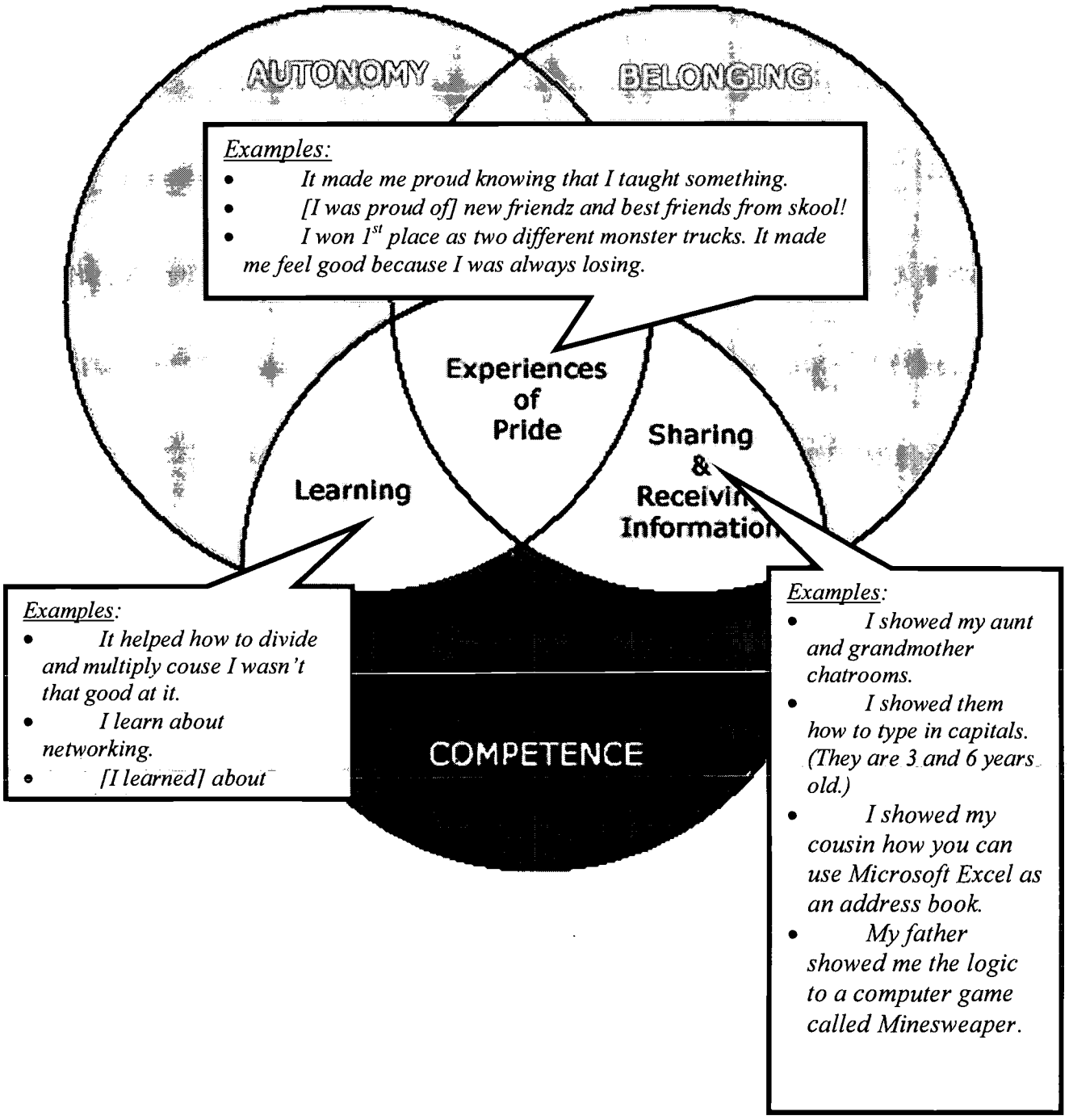

Figure 2: Percentage of participants engaging in specific computing activities at least once during the three-day journal study.

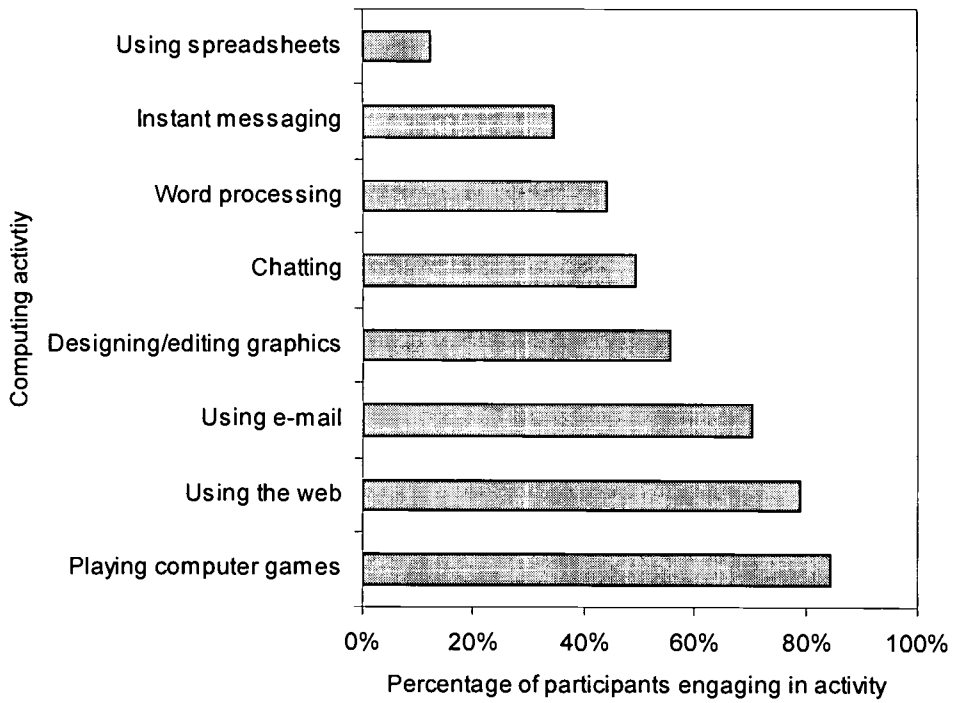

Figure 3: Percentage of participants reporting positive long-term impacts of home computing in the post-survey.

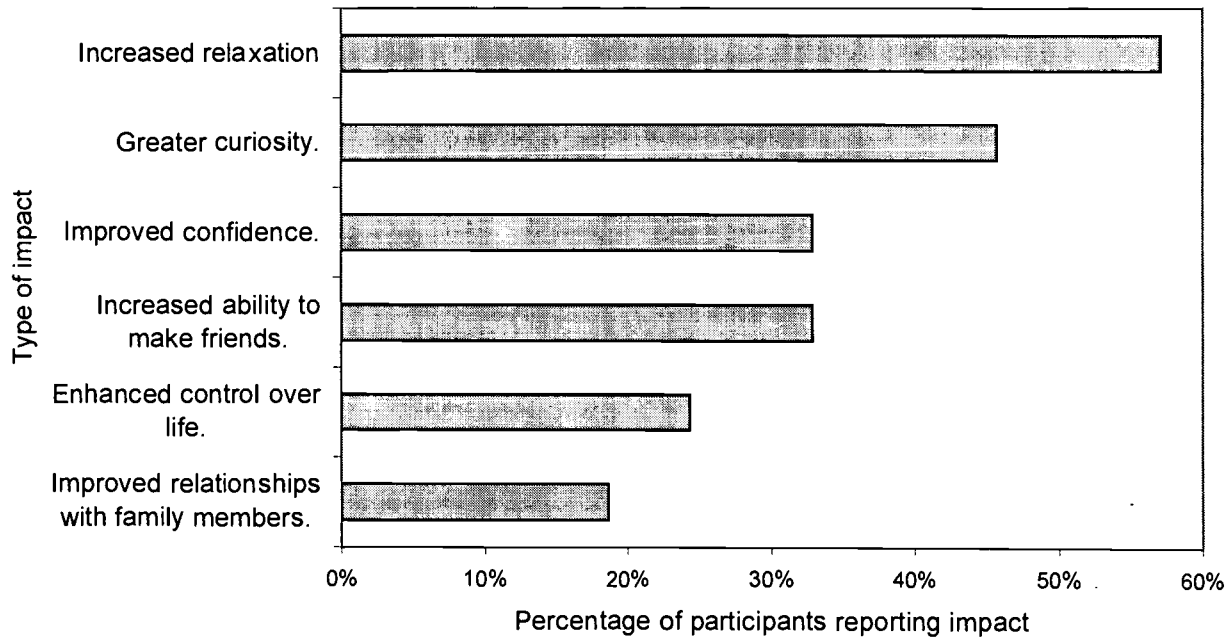

Table 1.

Adolescents' Sharing around the Home Computer

Type of sharing	***Examples from students' journal responses***
Basic hardware and software uses	How to hook up the monitor. How to install a game. How to set up a printer. I showed them how to type in capitals. (They are 3 and 6 years old.) How you can get on the Internet and search for what you need. I showed my brother how to look for different types of pictures. How to use a spreadsheet.
Computer-related activities participants find useful and enjoyable	I showed my aunt and grandmother chatrooms. I showed them the mtv.com singers like Nelly, JaRule, Mystical. How to save printer paper by saving on a document. How to play a game called 15 puzzle. How to get a smily face on instant messages. How to get a pen-pall and how to talk to ppl online.
Participants' own projects and products	Artwork I did. I explained to my mother that I made my own rythem or beat on a cool website. About what I can do on the computer.
More advanced/abstracted uses of computing	I showed my cousin how you can use Microsoft excel as an address book.

Table 2.
Adolescents' Pride about Their Home Computing Activities

Activities about which participants report pride	*Examples from students' journal responses*
Creating something on the computer	Make business cards. Some online creatures that I made. I wrote a little essay on my future. A picture card for my grandfather's birthday. A Power Point slide show. I wrote poems and I drew. My new music beat that I created on a website.
Improving skills and performance	To type faster. How to draw better. I won first place twice as two different monster trucks. It made me feel good because I was always losing.
Improving social relations	New friendz and best friends from skool! Make a new friend. Send my friends information without the phone and hearing other business.
Doing homework	I'm now 94% finished with my LA/ Literacy homework. It helped me finish my women's history month project.
Doing things together with others	I showed my dad how to do something on the computer. I showed my family things that they never knew. It made me proud knowing that I taught something [to younger siblings]. Me and my cousin made several art graphics. I was proud because we did it together.

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